

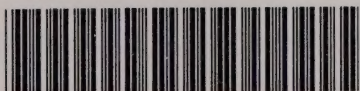
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A RECENT OBSERVATION ON FILARIA NOCTURNA
IN CULEX : PROBABLE MODE OF INFECTION OF
MAN.

G.C. LOW

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MCM.

was enlarged, and the abdomen markedly distended. The temperature reached the normal line on the thirtieth day.

The *post-mortem* appearances are also similar, as the following short notes of necropsies performed by Drs. FitzHugh and Handson demonstrate:

CASE V.—Trooper A. B., diagnosed as appendicitis followed by enterica. *Necropsy*: Typhoid ulceration of lower part of ileum. Appendix large, and surrounding area matted with adhesions. Some muco-pus in lumen of appendix. Spleen large and soft.

CASE VI.—Private H. B., diagnosed as enterica with perforation. *Necropsy*: Typhoid ulceration of ileum, towards the lower part of which was a large perforated ulcer. General suppurative peritonitis.

CASE VII.—Private G. W., diagnosed as enterica with broncho-pneumonia. *Necropsy*: Typhoid ulceration of ileum; broncho-pneumonia at both bases.

CASE VIII.—Private G. K., diagnosed as enteric. *Necropsy*: Typhoid ulceration of ileum; large spleen.

CASE IX.—Private A. W., diagnosed as enteric, with suppurative parotitis. *Necropsy*: Typhoid ulceration of ileum; large soft spleen; pus in both parotides.

CASE X.—Private E. T., diagnosed as enteric; hæmorrhages. *Necropsy*: Typhoid ulceration of ileum and cæcum; large quantity of dark blood in the intestines; towards the lower part of ileum a large ulcer, at the base of which was adherent clot; large soft spleen.

CASE XI.—Corporal A. B., diagnosed as traumatic suppurative arthritis of knee followed by enteric. *Necropsy*: Typhoid ulceration of ileum; large spleen; suppurative arthritis of knee.

CASE XII.—Private J. A., diagnosed as enteric, with pneumonia. *Necropsy*: Typhoid ulceration of ileum; broncho-pneumonia at both bases; large spleen.

Widal's Reaction.

In conjunction with Mr. Owen Richards I have also obtained in many cases typical clumping with a typhoid bacillus brought from England, and kindly given me by Dr. Eyre, of Charing Cross Hospital; for instance, in Case XI. In Case IV above quoted (Driver S.) a typical reaction was given with a dilution of 1 in 20.

Value of Inoculation.

It is, perhaps, premature to give an opinion with regard to the value of inoculation; but, as far as I can judge, it does not have a marked effect in mitigating the attacks. Two of our patients who died of enteric had been inoculated.

Dysentery followed by Enteric.

Several of our patients have suffered from dysentery and enteric fever, the latter immediately following the former.

"SIMPLE CONTINUED FEVER."

Many cases are sent to us with a diagnosis of "simple continued fever." Most of these are cases of enteric fever; nevertheless, now and then a case is met with in which the only symptoms are pyrexia and *malaise*, and which do not come into the category of any known diseases. It is possible that some of these are cases of influenza. The following is an example:

CASE XIII. *History*.—Private L., aged 20, admitted on May 1st under the care of Dr. Handson, had been ill for seven days. During this time he had had abdominal pain followed by diarrhoea; the stools were yellow. The temperature had been taken now and again, and had been found to range between 102° and subnormal.

Condition on Admission.—The tongue was furred, brown, and dry; the temperature was 101.6°. He had no headache; the abdomen was not distended; he had no abdominal pains or tenderness; the spleen could not be felt; there were no spots and no cough.

May 4th. The temperature was still raised in the morning but usually lower at night. It varied between 102° and 98.4° F. The bowels were somewhat constipated, the motions dark and hard.

May 6th. The tongue was still furred, white, but was now quite moist. Still there were no spots, the spleen was not palpable, and the abdomen not distended. The patient said he felt quite well, the bowels were still rather confined, and the temperature had been lower for the last few days.

May 12th. The temperature was normal and he felt quite well, and on May 21st it was noted that the temperature had remained normal. He had been on milk diet all along.

This patient never had any pain while in the hospital, and the only evidence of his illness were the furred tongue and the pyrexia. His blood was tested on May 9th but no clumping was observed.

ABSENCE OF MALARIA.

Dr. Saunders informs me that malaria is not infrequently diagnosed as arising in the Karroo, but that he has never met with a case in his own practice. We have had cases of malaria here in which the malaria parasites were present in the blood, but in all these cases the patients had previously suffered from malaria in India or elsewhere. We have, however, not met with a case of malaria arising in South Africa.

A RECENT OBSERVATION ON FILARIA NOCTURNA IN CULEX: PROBABLE MODE OF INFECTION OF MAN.

By GEORGE C. LOW, M.A., M.B. EDIN.,
Craggs Scholar, London School of Tropical Medicine.
[WITH COLOURED PLATE.]

WHILE working during the last three months in the London School of Tropical Medicine under Dr. Manson on a series of filariated mosquitoes (*Culex ciliaris*) forwarded to the latter by Dr. Bancroft, of Australia, I have been able to add some facts to our knowledge of the life-history of *Filaria nocturna*, facts which have special reference to the probable mode in which the human subject is infected by this parasite. They give also, if only indirectly, strong support to the inoculation theory of malaria, and add an additional argument, if such be required, for pushing forward the schemes now on foot for the protection of the human body from mosquito bite.

As is now well known, the filaria embryo, after being swallowed by certain species of mosquito, undergoes a metamorphosis in the thoracic muscles of these insects. In the stomach (Fig. 1) it casts its sheath. It then quits the stomach and enters the thoracic muscles (Fig. 2), in which it passes through various changes (Figs 3 and 4). These result in the acquisition of vastly increased size, a mouth and alimentary canal, and a peculiar trilobed caudal appendage (Fig. 7). Until Bancroft's recent observations it was supposed that the filaria on the death of the mosquito—an event which was generally believed to occur in the water on which the insect had laid her eggs for the first and last time—quitted the body of its defunct intermediary host, entered the water, and through this medium obtained access to the alimentary canal, and ultimately the lymphatic system of man. The principal reasons for this supposition were:

(a) That mosquitoes confined in vessels after they had fed on human blood deposited their eggs about the end of a week and almost immediately thereafter died, and

(b) That the developed filaria on the completion of its evolution in the mosquito exhibited remarkable activity when placed in water, and a capacity for living in this medium for, at all events, several hours—an activity and capacity suggesting that water is its natural habitat at this stage of its life.

Ross, and subsequently Bancroft and others, have now shown that the female mosquito if fed can go on living and laying for many weeks after the meal on human blood and after depositing her first batch of eggs, provided she is supplied with nutriment, whether in the form of animal or of vegetable juices. It is manifest, therefore, that any filariae she may contain must find some other means for quitting the body of their intermediary insect host, and of getting access to the tissues of the definitive human host. Bancroft made two suggestions—(a) that the filaria might be swallowed by man while still in the mosquito—a somewhat improbable as well as unnatural event; (b) that it might be stimulated to re-enter the oesophagus of a mosquito when the latter came to feed again on a human subject, and so creep along the proboscis by the natural channel and thus into human tissues. How near suggestion b is to the truth the following observations show:

To study the anatomy of the mosquito in reference to any possible migrations of the worms, sections of filariated mosquitoes were cut after embedding in celloidin and stained. In serial sections of infected insects, killed at various times both before and after the final stage of the metamorphosis, it was found that the young filariae, after reaching their highest stage of development in the insect, instead of lying passively in the thoracic muscles, leave that tissue, and, in the vast majority of instances, travel forward in the direction of the head of the mosquito, and pass into the loose cellular tissue which abounds in the prothorax in the neighbourhood of the salivary glands. Although the large majority of the filariae take up this position very constantly, an occasional straggler is seen in the tissues between the thorax and abdomen, or in the abdomen itself even as far back as the Malpighian tubes, or in the neighbourhood of the ovisacs. The situations last named are distinctly unusual. If we disregard these exceptional stragglers it will be found that the worms, after a short stay in the prothorax, pass along the neck, enter the lower



Fig. 1.



Fig. 1a.

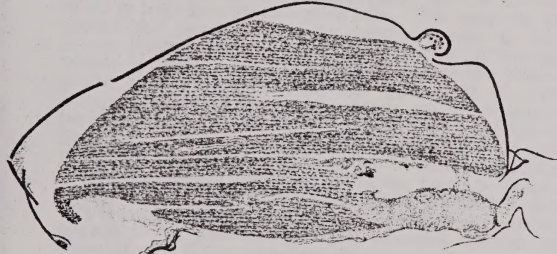


Fig. 2.



Fig. 2a.

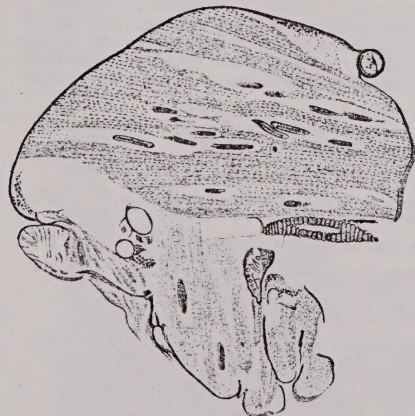


Fig. 3.

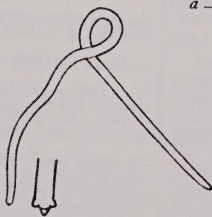


Fig. 7.

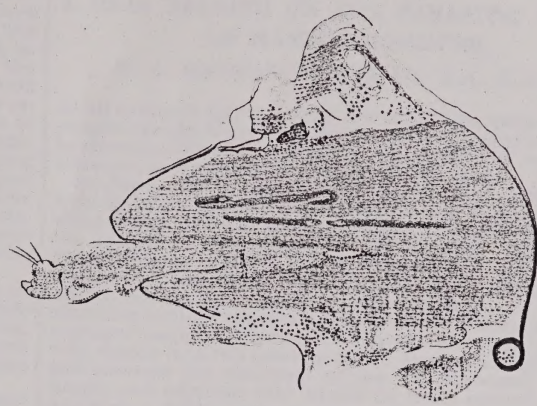


Fig. 4.

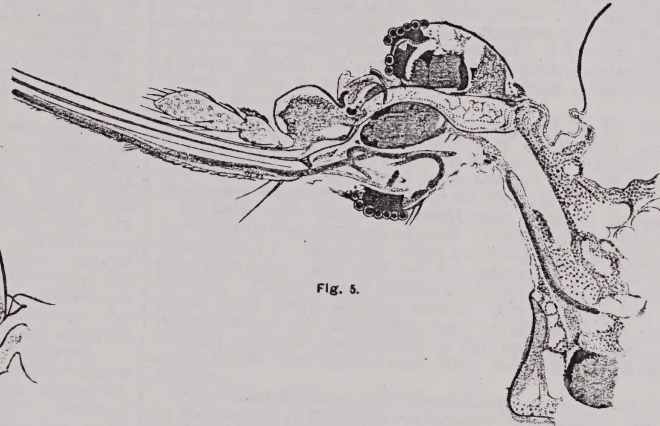


Fig. 5.

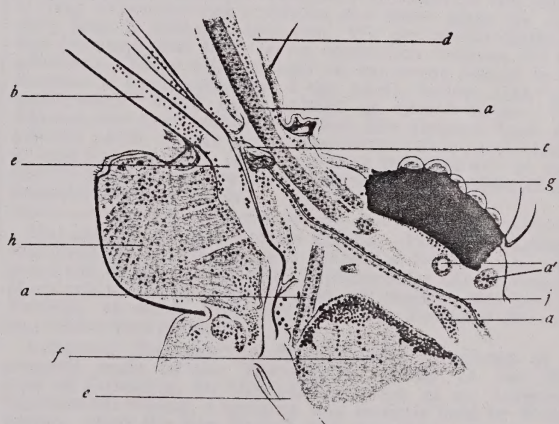


Fig. 6.

part of the head, and coil themselves up in the loose connective tissue immediately below the cephalic ganglion and the salivary duct (Fig. 5). Rarely are they found above the cephalic ganglion. From the head they can be traced, in fortunate sections, passing into the proboscis; not along the salivary duct as is the case with the malarial parasite, for this channel is manifestly too minute to accommodate a body relatively so gigantic as the filaria; not along the oesophagus or pharynx, as Bancroft suggested; but by making an independent passage through the base of the labium, and pushing forwards along the proboscis between labium and hypopharynx amongst the stiletts. Here I have frequently found them stretching along almost the entire length of the proboscis, the head being invariably in advance (Fig. 5 and 6). Strange to say two worms nearly always lie together in the proboscis, their heads being, so to speak, *tête-à-tête*.

It is difficult to avoid the deduction that the parasites so situated are there normally, awaiting an opportunity to enter the human tissues when the mosquito next feeds on man. The sections when made on filarated insects at any period after the third week in every instance contained parasites either in the head, or in the proboscis, or in both.

It is interesting in connection with this fact to remember that these insects after their meal on human blood had subsequently frequently fed on fruit juices. To keep them alive for the necessary time to permit of the evolution of the filaria this mode of feeding had to be resorted to. From this we may infer that the parasite has the power of discriminating between vegetable and animal juices. For did it not possess this faculty of discrimination our mosquitoes would have shown no filariae, as the parasites might have been expected to have passed out into the bananas on which they had been feeding long before the date at which they were killed.

Without actual and somewhat dangerous experiment it would be rash positively to assert that the filaria is inoculated directly into man by mosquito bite. Nor may we absolutely ignore the possibility of its gaining access to the human tissue through the medium of water or of vegetable into which it might have escaped by way of the proboscis, the cloaca, or along with the insects' eggs. But the evidence of design implied by the position taken up by the parasite in the proboscis, and its declining to quit this position when the mosquito feeds on vegetable juices, are suggestive, and almost prove that the mosquito bite is the natural and, probably, the constant and only opportunity for the filaria to enter upon its next and final stage of development in the definitive host.

It is interesting to note that although degenerative changes appear to be produced in the muscles of the mosquito, especially by the more advanced forms of the filaria, nothing of the nature of inflammatory change or of encystment, as in the case of trichina infection of vertebrate muscle, is ever observed. And, further, that the rate of development is not uniform; sometimes advanced forms are found as early as the eleventh day, or immature forms so late as the third week from the presumed time of infection.

Bancroft is inclined to doubt Manson's statement that the filaria casts its sheath before quitting the stomach of the mosquito; in several of my sections the empty sheath is plainly visible in the blood contained in the stomach, thus proving that ecdysis is not an artificial phenomenon.

DESCRIPTION OF COLOURED PLATE.

- Fig. 1.—*Filaria nocturna* in the blood in the stomach of newly fed mosquito. $\times 60$. Fig. 1a, the same, isolated, $\times 125$. (Australia.)
 Fig. 2.—*F. nocturna* lying in thoracic muscle of mosquito after quitting stomach; first day after feeding, $\times 60$. Fig. 2a, the same, isolated, $\times 125$. (China.)
 Fig. 3.—*F. nocturna* in thoracic muscle of mosquito 9 days after feeding. Great increase in size; commencing differentiation of alimentary canal. (Madras.)
 Fig. 4.—*F. nocturna* in thoracic muscles 11 days after feeding; development nearly complete. (Australia.)
 Fig. 5.—*F. nocturna* in head and proboscis of mosquito 20 days after feeding. Shows parasites coiled up below cephalic ganglion and extending along proboscis between labium and hypopharynx $\times 60$; part of another filaria can be seen passing along the neck from the prothorax to the head. (Australia.)
 Fig. 6.—High power view of another section showing exact route by which the filaria enters the proboscis. The salivary duct is seen entering base of hypopharynx. (a) Fragments of filaria; (b) labrum; (c) base of hypopharynx; (d) labium; (e) pharynx; (f) cephalic ganglion; (g) eye; (h) muscle; (i) salivary duct opening into base of hypopharynx. (Australia.)
 Fig. 7.—*Filaria* dissected out of mosquito 50 days after feeding. The tail with its appendages shown more highly magnified. (Australia.)

A CASE BEARING ON THE PARASITIC NATURE OF MAMMARY CANCER.

By A. MARMADUKE SHEILD, M.A., F.R.C.S.

As all evidence bearing upon the important question of the parasitic origin of cancer of the breast is of importance, I wish to place the following remarkable case shortly on record, for a reference to it may in future years be of utility.

In June, 1898, a married woman, aged 36, came to me with irritation and redness about the left nipple. The area affected was of trivial extent, about 2.3 cm. in diameter, and the symptoms had existed for six months. Some simple remedies were applied, and I watched the case for a few weeks, as I was by no means certain of the diagnosis. At length certain appearances of the well-known "raw" red character inclined me to the belief that the disease was of the nature of malignant dermatitis (Paget's disease). This view was shared by a full meeting of the Dermatological Society, and moreover the universal opinion was expressed that the nipple and adjacent skin should be freely removed. I may add that so-called psorosperms were found in scrapings of the patch, but there was no perceptible deep induration or signs of cancer present. Wishing, as I thought, to make sure of the prevention of cancer, I went further, and advised the patient to submit to removal of the whole breast. To this after much reluctance she consented, and the mamma and pectoral fascia, with a large area of skin, were removed. I did not remove the axillary glands, because I believed that carcinoma of the breast had not yet developed, and that I was exercising merely a precautionary measure.

The affected skin was kindly examined by Dr. Rolleston, who found the usual appearances of malignant dermatitis, but no evidence of carcinoma in the breast beneath. I may add that I made a special note that to the naked eye the mammary substance was quite unaffected.

All went well until the present year, when in the month of April the patient noticed a small "lump" in the skin near the sternal end of the scar. This swelling was hard, about the size of a large pea, and red in colour. I excised it freely in May. Examination shows it to be spheroidal-celled carcinoma, with much fibrous tissue. The sections are in the possession of Dr. Rolleston, and he informs me that they exhibit extreme vacuolation of the epithelial cells, appearances which have in the past often been described as psorosperms.

This disappointing but remarkable case shows that the infective nature of so-called malignant dermatitis of the nipple is very extensive and insidious, and takes place far more early than is generally believed. We can hardly doubt, in this instance, that there was a connection between the two affections. There was certainly no cancerous change in the mamma to be detected, and I can hardly believe that "cell proliferation" could have existed or spread so far. The mamma was very voluminous, and the distance from the affected patch of skin to the secondary nodule considerable, at least 6 to 8 inches. It is hoped that this case will be read and commented upon by those working at the subject of the parasitic origin of cancer.

MALARIA IN THE SUB-ALPINE REGION.—Professor Pagliani, President of the Piedmontese Society of Hygiene, has proposed the establishment of a propaganda for the prevention of malaria in the Sub-Alpine region. A meeting was held at Verelli, at which Professor Bizzozero, Professor Bozzolo, and others were present.

AMERICAN THERAPEUTIC SOCIETY.—In pursuance of a proposal made by the Therapeutic Society of the District of Columbia, for the establishment of an American Therapeutic Society, a meeting was recently held in Washington, when the new Society was organised. Dr. Horatio C. Wood was elected President. Among the members of Council we note the names of Professor W. Osler of Baltimore, Professor H. J. Hare, Dr. J. V. Shoemaker, and Professor Tyson of Philadelphia. The Society will become affiliated with the Congress of American Physicians and Surgeons, which meets in Washington every three years. The meetings of the American Therapeutic Society will be held annually.

